

Biology (Ph.D., M.S.)

[View PDF of Biology Admissions Checklist](#)

Prospective students should use this checklist to obtain specific admissions requirements on how to apply to Graduate School.

[View PDF version of the Biology catalog description](#)

Degree Offered:	Ph.D., M.S., 5th Year M.S.
Director:	<i>Watts</i>
Phone:	(205) 934-9645
E-mail:	sawatts@uab.edu
Web site:	www.uab.edu/biology/

Faculty

Charles D. Amsler, Professor (Biology); Ecophysiology and Chemical Interactions

Robert A. Angus, Professor (Biology); Population Biology, Genetics of Fish, Environmental Biology

Asim K. Bej, Professor (Biology); Microbial Ecology, Molecular Genetics

James A. Coker, Assistant Professor (Biology); Biochemistry, genetics/genomics, molecular biology of extremophilic microorganisms

Anne Cusic, Associate Professor (Biology)

[Robert U. Fischer](#), Chair and Professor (Biology); Aquatic Ecology, Fisheries Biology, and Physiological Ecology

Vithal K. Ghanta, Professor (Biology); Tumor Immunology, Aging and Immune System

Roger Gilchrist, Assistant Professor (Biology)

David T. Jenkins, Associate Professor (Biology); Taxonomy, Nomenclature, and Cultural Studies of Basidiomycetes

Ken R. Marion, Professor (Biology); Population Dynamics, Reproductive Cycles, Environmental Cues for Reproduction

James B. McClintock, Professor (Biology); Invertebrate Reproduction, Ecology

Karolina M. Mukhtar, Assistant Professor (Biology); Plant-Pathology Interactions,

Transcriptional Networks

Dana Petterson,

Robert W. Thacker, Associate Professor (Biology); Community and Behavioral Ecology, Molecular Systematics

Trygve O. Tollefsbol, Professor (Biology); Developmental Biology and Molecular Biology of DNA Methylation

R. Douglas Watson, Professor (Biology); Endocrinology, Neuroendocrinology, Insect Development

Stephen A. Watts, Professor (Biology); Nutrition, Physiology and Growth of Marine and Aquatic Organisms; Aquaculture

Thane Wibbels, Professor (Biology); Comparative Reproductive Physiology of Vertebrates

Program Information

Areas of Specialization

Graduate students in the M.S. and Ph.D. programs in biology may specialize in research activities at all levels of biological organization, with emphases on ecophysiology, cellular and molecular biology, endocrinology, and ecology of aquatic organisms, or on models related to human disease.

Admission

For admission in good standing, applicants must meet the following requirements, in addition to the Graduate School's standards: an undergraduate degree in a biological science, B-level scholarship in all biology courses, two semesters of organic chemistry, two semesters of physics, mathematics through calculus, and minimum combined verbal and quantitative score of 1150 on the GRE General Test, and a personal statement of career goals. The graduate program director in biology must approve admission on probation or with deficiencies in one of the above requirements. Three letters of evaluation from individuals who have a thorough knowledge of the applicant's academic abilities and potential are also required. Students may enter at the beginning of any semester.

Coursework, Thesis, and Dissertation

A dissertation embodying the results and analysis of an original experimental investigation is required for Ph.D. candidates. Students in the M.S. program may write a thesis based on a research project (Plan I) or, alternatively, may elect to submit a nonresearch project incorporating a review and analysis of one or more topics of current or historical interest in

biology (Plan II).

Since scientific problems encountered today are multifaceted and require multidisciplinary approaches, students are expected to acquire a broad background in the physical and life sciences. Doctoral students must complete formal course work in or have equivalent training related to six of the following seven areas: ecology, physiology, cell biology, developmental biology, genetics, microbiology, and molecular biology. Master's students must have competency in five of these life-science areas. Each student is also expected to satisfactorily complete a course or sequence in biometry and any advanced courses designated by the student's graduate study committee consistent with the chosen area of specialization.

Each student must also enroll in three seminar courses approved by his or her graduate study committee, and one of the seminars must be outside the student's primary area of specialization. Also, each student is required to demonstrate proficiency in teaching by delivering formal course lectures or by conducting instructional laboratories.

Examinations

To qualify for candidacy, a student in the Plan I master's program must satisfactorily complete either a written or an oral comprehensive examination. A doctoral student must take both written and oral comprehensive examinations. As part of a student's final defense of his or her dissertation or thesis, a public departmental seminar must be presented.

Class A Teaching Certification

Under the Alabama Department of Education's "Strengthened Subject Matter Option," students who complete requirements for the master's degree in biology can also receive class A teaching certification, providing that certain prerequisites and requirements are met. Complete details are available from the School of Education Certification Office, EB 100, 1530 3rd Avenue South, Birmingham, Alabama 35294-1250 (Telephone 205-934-5423).

Additional Information & Mailing Address

Deadline for Entry Term(s):	Each semester
Deadline for All Application Materials to be in the Graduate School Office:	Eight weeks before semester begins
Number of Evaluation Forms Required:	Three
Entrance Tests	GRE (TOEFL and TWE also required for international applicants whose native language is not English.)

Contact Information

For detailed information contact Dr. Stephen A. Watts, Graduate Program Director, UAB Department of Biology, CH 375, 1530 3rd Avenue South, Birmingham, Alabama 35294-1170.

Telephone 205-934-9685

Fax 205.975.6097

E-mail sawatts@uab.edu

Web www.uab.edu/uabbio

Physical Address

UAB Department of Biology, Campbell Hall, Room 464, 1300 University Blvd., Birmingham, Alabama 35294-1170

Course Descriptions

Unless otherwise noted, all courses are for 3 semester hours of credit. Course numbers preceded with an asterisk indicate courses that can be repeated for credit, with stated stipulations.

Biology (BY)

501. **Advanced Biology for Teachers I – (Genetics)**. Basic genetic principles; recent research developments. Prerequisite: Permission of instructor.

502. **Advanced Biology for Teachers II – (Botany)**. Provides understanding of human structural and functional relationships essential in modern biology. Corequisite: BY 503.

507. **Microbial Ecology**. Microorganisms in nature; interactions with each other and with environment. Independent project required. Prerequisite: BY 271.

511. **Molecular Genetics**. Prokaryotic and eukaryotic gene structure and function. Prerequisites: BY 271 and 330, and CH 232. Independent project required.

520. **General Endocrinology**. Principles of chemical communication in animals. Use of invertebrate and vertebrate systems. Prerequisite: BY 309 or permission of instructor.

531. **Advanced Recombinant DNA Technology**. Manipulation of genes and their regulations, and techniques used in recombinant DNA technology. Independent project required. Prerequisites: BY 311 and 330, and CH 233 and 461. Lectures and laboratories.

535. **Natural History of the Vertebrates**. Adaptations of vertebrates for survival in particular environments. Survey and classification of local vertebrates. Two lectures, one laboratory or field trip per week. Independent project required. 4 hours.

540. **Biology and Aging**. Current understanding of aging, measuring aging changes, theories of aging and aging changes in various human systems. Prerequisite: BY 103 or permission of

instructor.

552. **Field Botany.** Principles and techniques of plant identification and classification; consideration of phylogenetic systems. Lecture and field trips. Independent project required. 4 hours.

560. **Advanced Invertebrate Zoology.** Selected topics. Lecture and student projects. Prerequisite: BY 255 or permission of instructor.

565. **Limnology.** Biology of freshwater and estuarine organisms. Lecture, laboratory, and field trips. Prerequisites: BY 104 and 370 or permission of instructor. 4 hours.

567. **Tropical Ecology.** An overview of the major tropical ecotypes with emphasis on ecology of terrestrial, aquatic, and marine tropical organisms. Prerequisite: BY 255 or 370 or permission of instructor. Major portion of course taught at a tropical field station in the Caribbean. Lectures, laboratory, and field trips. Library research paper required.

568. **Galapagos Ecology.** An overview of the ecology of the Galapagos Island, with an emphasis on the ecology of terrestrial and marine organisms. Major portion of course conducted on the Galapagos Islands. Lecture and field trips (May session, alternate years). *Prerequisite:* BY 124 and Permission of Instructor.

569. **Rain Forest Ecology.** Overview of physical and environmental factors that structure the rainforest, biodiversity of life, and interactions of its organisms. A survey of prominent biota will be conducted. Prerequisites: BY 255 or 256 or 370 and permission of instructor. Major portion of course taught in Costa Rica. Lectures and field trips. Library research paper required.

570. **Ecology.** Ecosystems and population biology. Lectures, laboratories, and field trips. Independent project required. Prerequisite: BY 255 or 256.

571. **Biochemical Adaptations to Environment.** Examination of physiological and biochemical adaptations of organisms to physical environment. Prerequisites: BY 309 and 330 and CH 460, or permission of instructor.

*595. **Special Topics in Biology I.** Lecture, laboratory, or both. 1-4 hours.

*596. **Special Topics in Biology II.** Lecture, laboratory, or both. 1-4 hours.

605. **Microbial Physiology.** Microbial structure and function, growth, metabolism, and regulation of cellular activity. Independent project required. Prerequisites: BY 271 and 3 semester hours of organic chemistry.

607. **Microbial Ecology.** Microorganisms in nature; interactions with each other and with the environment. Independent project required. Prerequisite: BY 271.

610. **Comparative Animal Physiology.** Special physical and chemical processes occurring at

cell tissue, and organ levels. Independent projects required. Prerequisite: BY 309 or permission of instructor.

611. **ADVANCED HUMAN ANATOMY.** This course will provide students with an interest in medical and health sciences a detailed examination of human anatomy. The lecture/seminar will correlate detailed knowledge of human anatomy with cutting-edge surgical and medical advances including hypothermic treatment of spinal cord trauma, bioengineering of synthetic scaffolds for organ and limb regeneration and nano-particle drug delivery systems. Laboratory sessions will be devoted to focused observation of prosected cadavers and small student-team dissection of entire cadavers. *Prerequisite:* BY 115 or permission of the instructor.

616. **Cellular Physiology.** Structure and function of cells and their components at the molecular level. Laboratory experience using modern equipment and biochemical methods. Independent project required. Prerequisites: BY 309 or 330 and CH 232. 4 hours.

619. **Reproductive Physiology.** Comparative reproductive physiology in animals with emphasis on mammals. Independent project required. Prerequisites: BY 256 and 3 semester hours of organic chemistry.

626. **Evolutionary Medicine.** An evolutionary approach to issues relating to human health and disease. *Prerequisites:* (BY 116 or BY 409) and BY 330 or permission of instructor.

628. **Biology Laboratory Teaching Techniques.** Student will assist in instruction of an introductory biology laboratory. Responsibilities will also include preparation of quizzes and practicals and designing and conducting an instructional laboratory exercise. Prerequisites: Permission of instructor.

629. **Evolution.** Introduction to the study of evolutionary processes *Prerequisites:* BY 210.

633. **Advanced Molecular Genetics.** Examination of the molecular genetics of eukaryotic organisms, including genomes, nucleosomes, chromosomes, transcription, splicing, transposition and signal transduction. The role of molecular biology in immune diversity and cell growth will also be studied. Prerequisites: BY 311 and 431.

640. **Immunology.** Immune system and functions of host humoral and cellular immune responses. Mechanisms of antigen and antibody reactions and basic immunological methods. Independent project required. Prerequisites: BY 271, BY 330, and CH 231.

642. **Experimental Phycology.** Introduction to algae. Experimental approaches to productivity. Algae as model systems. Independent project required. Prerequisites: BY 104 and either BY 330, BY 450, and CH 462, or permission of instructor. Lecture and laboratory. 4 hours.

646. **Techniques in Biological Research I.** Concepts and practical application of techniques pertinent to biological research. Prerequisites: Permission of instructor. Lecture and laboratory.

648. **Psychoneuroimmunology.** Explores communication between neuroendocrine and immune

systems. Prerequisite: Permission of instructor. 3 hours

652. **Field Botany for Teachers.** Principles and techniques of plant identification and classification; consideration of phylogenetic systems. Lectures and field trips. Independent project required. Prerequisite: BY 260 or permission of instructor. 4 hours.

653. **Mycology.** Fungi, including morphology, development, physiology, taxonomy, and phylogeny. Independent project required. Prerequisites: BY 260 or 271 and 3 semester hours of organic chemistry. Lecture and laboratory. Offered at irregular intervals. 4 hours.

655. **Biometry.** Methods of data summary, presentation and analysis and the use of computer statistical applications. Lectures and computer laboratories.

662. **Introductory Neurobiology.** Introduction to biological basis of nervous system function. Comparative approach applying molecular, cellular, and systems' concepts to nervous system function is used to examine electrical and chemical signaling, neural circuitry, and cellular basis of behavior and neural development. Independent project required. Prerequisites: BY 309, CH 231, and PH 101.

665. **Limnology.** Introduction to ecology of inland waters and estuaries. Lectures and field trips. Prerequisite: BY 255 or 256. 4 hours.

667. **Population Ecology.** Structure and dynamics of populations with an emphasis on understanding how reproduction, mortality and dispersal interact to control fluctuations in population size and structure. Quantitative Literacy is a significant component of this course (QEP). *Prerequisites:* BY 124. 669. **Molecular Ecology and Phylogenetics.** Course will survey processes and patterns of molecular evolution and methods of phylogenetic analysis using DNA sequences, amino acid sequences, and molecular markers. *Prerequisites:* BY 124 and BY 210, or permission of instructor.

671. **Biochemical Adaptations to Environment.** Examination of physiological and biochemical adaptations of organisms to physical environment. Prerequisites: BY 309 and 330 and CH 460, or permission of instructor.

673.- **Chemical Ecology.** Chemical interactions between organism and chemical sensing of the environment, including chemical defenses against threats and chemical communication between individuals. *Prerequisites:* BY 124 and CH 235 or permission of instructor.

675. **Mammalian Embryology.** Examination of control mechanisms of embryonic development at molecular level and differentiation from fertilization through gestation. Mechanisms of abnormal embryonic development. Prerequisite: BY 314.

*681. **Seminar in Physiological Ecology.** Current research. 1 hour.

*682. **Seminar in Immunology.** Current research. 1 hour.

- *683. **Seminar in Physiology.** Current research. 1 hour.
- *684. **Seminar in Microbial Ecology.** Current research. 1 hour.
- *685. **Seminar in Cell Biology.** Current research. 1 hour.
- *686. **Seminar in Mammalian Development.** Current research. 1 hour.
- *687. **Seminar in Endocrinology.** Current research. 1 hour.
- *688. **Seminar in Algal Ecophysiology.** Current research in specific areas. 1 hour.
- *689. **Seminar in Genetics.** Current research. 1 hour.
- *690. **Seminar in Cellular Physiology.** Current research in specific areas. 1 hour.
- *691. **Seminar in Botany.** Current research developments. 1 hour.
- *692. **Seminar in Ecology.** Current research. 1 hour.
- *693. **Seminar in Embryology.** Current research. 1 hour.
- *694. **Seminar in Microbiology.** Current research in microbial ecology and microbial physiology. 1 hour.
- *695. **Special Topics in Biology I.** Lecture, laboratory, or both. 1-4 hours.
- *696. **Special Topics in Biology II.** Lecture, laboratory, or both. 1-4 hours.
- *697. **Investigative Techniques.** Application of modern experimental techniques in solving research problems. 1-2 hours.
- *698. **Nonthesis Research.** 1-10 hours.
- *699. **Thesis Research.** Prerequisite: Admission to candidacy. Pass/Fail. 1-10 hours.

746. **Techniques in Biological Research I.** Concepts and practical application of techniques pertinent to biological research. Prerequisites: Permission of instructor. Lecture and laboratory.

755. **Biometry.** Methods of data summary, presentation and analysis and the use of computer statistical applications. Lectures and computer laboratories.

767. **Population Ecology.** Structure and dynamics of populations with an emphasis on understanding how reproduction, mortality and dispersal interact to control fluctuations in population size and structure. Quantitative Literacy is a significant component of this course

(QEP). *Prerequisites:* BY 124.

769. Molecular Ecology and Phylogenetics. Course will survey processes and patterns of molecular evolution and methods of phylogenetic analysis using DNA sequences, amino acid sequences, and molecular markers. *Prerequisites:* BY 124 and BY 210, or permission of instructor.

771. Biochemical Adaptations to Environment. Examination of physiological and biochemical adaptations of organisms to physical environment. Independent project required. *Prerequisites:* BY 309 and 330, and CH 461, or permission of instructor.

*781. **Seminar in Physiological Ecology.** Current research. 1 hour.

*782. **Seminar in Immunology.** Current research. 1 hour.

*783. **Seminar in Physiology.** Current research. 1 hour.

*784. **Seminar in Microbial Ecology.** Current research. 1 hour.

*785. **Seminar in Cell Biology.** Current research. 1 hour.

*786. **Seminar in Mammalian Development.** Current research. 1 hour.

*787. **Seminar in Endocrinology.** Current research. 1 hour.

*788. **Seminar in Algal Ecophysiology.** Current research in specific areas. 1 hour.

*789. **Seminar in Genetics.** Current research. 1 hour.

*790. **Seminar in Cellular Physiology.** Current research in specific areas. 1 hour.

*791. **Seminar in Botany.** Current research developments. 1 hour.

*792. **Seminar in Ecology.** Current research. 1 hour.

*793. **Seminar in Embryology.** Current research. 1 hour.

*794. **Seminar in Microbiology.** Current research in microbial ecology and microbial physiology. 1 hour.

*795. **Special Topics in Biology I.** Lecture, laboratory, or both. 1-2 hours.

*796. **Special Topics in Biology II.** Lecture, Laboratory, or both. 1-2 hours.

*797. **Investigative Techniques.** Application of modern experimental techniques in solving research problems. 1-2 hours.

*798. **Nondissertation Research.** 1-10 hours.

*799. **Dissertation Research.** Prerequisite: Admission to candidacy. Pass/Fail. 1-10 hours.

Marine Science (MESc)

In addition to the course offerings listed below, certain courses given through the Marine Environmental Sciences Consortium at Dauphin Island, Alabama, may be taken for graduate credit. For detailed information, contact Dr. Ken R. Marion, Department of Biology, Campbell Hall, Room 173, 1300 University Boulevard, Birmingham, Alabama 35294-1170.

Telephone 205-934-3582

E-mail kmarion@uab.edu

611. **Marsh Ecology.** Habitat analysis, natural history studies, and population dynamics of selected marsh organisms. Lecture, laboratory, and fieldwork. 4 hours.

612. **Marine Ecology.** Bioenergetics, community structure, population dynamics, predation, completion, and speciation in marine ecosystems. Lecture, laboratory, and fieldwork. 4 hours.

614. **Advanced Marine Ecology.** Mechanisms controlling the distribution of marine organisms. Major concepts in marine ecological theory. 2 hours.

615. **Coastal Ornithology.** Coastal and pelagic birds, with emphasis on ecology, taxonomy, and distribution. Lecture, laboratory and field trips. 4 hours.

618. **Benthic Ecology.** Factors controlling life cycles of marine benthic organisms and organization of their communities. 2 hours.

619. **Marine Microbial Ecology.** Survey of the types of microorganisms found in the marine environment and their interactions with each other and their environment. Lecture and laboratory.

620. **Coastal Ecosystems Dynamics.** Investigation of the structure and function of a variety of coastal ecosystems and evaluation of energy and nutrient processing in disparate ecosystems. 2 hours.

621. **Marine Plankton.** Taxonomy and biology of marine phytoplankton, bacterioplankton and zooplankton. Lecture and laboratory.

622. **Chemical Oceanography.** An in-depth examination of the chemistry of seawater and its relationship with biological, geological and physical processes in the oceans.

623. **Geological Oceanography.** Historic and current consequences of both geophysical and classic geological processes as they relate to the marine environment. Tectonic theory,

sedimentary processes, stratigraphy, micropaleontology, erosion, and the formation of hydrocarbons. Lecture and laboratory.

625. **Physical Oceanography.** Physical properties of the world's oceans. Waves, tides, circulations, fluctuations, and interactions of the sea with the atmosphere and landmasses.

626. **Biological Oceanography.** Chemical, physical, and geological patterns and processes important in the interaction of organisms and the sea.

627. **Fisheries Oceanography.** Examination of the relationships between fish life history, recruitment dynamics and harvest potential, and local-, meso-, and global-scale oceanography processes. 2 hours.

629. **Fisheries Techniques.** Current biological and technological methodologies for studying fishes and aquatic habitats, with emphasis on study design and integration across subdisciplines.

630. **Marine Biogeochemical Processes.** Understanding how biogeochemical processes regulate ecosystem function in the marine environment. 2 hours.

631. **Sediment Biogeochemistry.** Sediment biogeochemical processes and their effects on nutrient cycles, plant production, and animal distribution. Lecture and laboratory.

632. **Ocean Variability and Global Change.** Examination of large-scale, spatial and temporal variability in the earth/ocean system. 2 hours.

633. **Marine Biogeography and Paleobiology.** Overview of the time course of evolutionary changes in marine ecosystems and the role of historical factors influencing the distribution of marine organisms. Lecture and field trip.

634. **Marine Resource Management.** Management of marine resources, development of legislation, and impacts of management on human resources. 2 hours.

635. **Marine Analytical Instrumentation.** Overview of the major analytical tools available to marine scientists. Lecture and laboratory.

636. **Oceanographic Experiences.** Participation in an oceanographic research cruise. Research project report. 1-3 hours.

670. **Field Marine Science.** Two-week field exercise at selected sites along the Gulf of Mexico and Atlantic shoreline of North America. Pretrip lectures and readings. 2 hours.

692. **Seagrass Ecosystem Ecology.** Ecology of seagrass systems of estuarine environments. 2 hours.

693. **Seminar in Marine Science.** Current research. 1 hour.

694. **Directed Studies on Marine Topics.** Research on marine topics. 1-6 hours.
696. **Special Topics in Marine Science.** Lecture, laboratory, or both. 1-6 hours.
714. **Advanced Marine Ecology.** Mechanisms controlling the distribution of marine organisms. Major concepts in marine ecological theory. 2 hours.
718. **Benthic Ecology.** Factors controlling life cycles of marine benthic organisms and organization of their communities. 2 hours.
719. **Marine Microbial Ecology.** Summary of the types of micro-organisms found in the marine environment and their interactions with each other and their environment. Lecture and laboratory.
720. **Coastal Ecosystems Dynamics.** Investigation of the structure and function of a variety of coastal ecosystems and evaluation of energy and nutrient processing in disparate ecosystems. 2 hours.
721. **Marine Plankton.** Taxonomy and biology of marine phytoplankton, bacterioplankton and zooplankton. Lecture and laboratory.
722. **Chemical Oceanography.** An in-depth examination of the chemistry of seawater and its relationship with biological, geological and physical processes in the oceans.
723. **Geological Oceanography.** Historic and current consequences of both geophysical and classic geological processes as they relate to the marine environment. Tectonic theory, sedimentary processes, stratigraphy, micropaleontology, erosion, and the formation of hydrocarbons. Lecture and laboratory.
725. **Physical Oceanography.** Physical properties of the world's oceans. Waves, tides, circulations, fluctuations and interactions of the sea with the atmosphere and landmasses.
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nutrient cycles, plant production and animal distribution. Lecture and laboratory.

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Last modified 03/16/11